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Southern Research Institute

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March 18, 1963

AIR MAIL

Commanding Officer
U.S. Army Chemical
Research and Development
Edgewood Arsenal, Maryland

Attention: Mr. Abraham Koblin
Contract Project Officer

Reference: Monthly Progress Report
Contract No. DA18-108-AMC-32-A

Dear Sir:

The study to develop instruments for measuring particle size and concentration of chemical agents was continued during February. Most of the month was spent on the evaluation of the components for the aerosol flash camera and on the development of electronics for the flash camera. A television camera and flash lamp for the breadboard model instrument were ordered early in March. This report outlines the plans for basic experiments to learn more about the factors affecting the response time of the electrochemical cell and gives some of the considerations that led to the present design concept of the flash camera. Plans are also given for the construction and evaluation of the camera.

The electrochemical cell may be used as a total agent measuring device and the present cell design can be modified to read concentration as a function of time. To be useful for this purpose the response time of the cell should be reduced. Some of the factors affecting the response time of the cell are: absorption of the agent by the oxime, reaction rate of the agent with the oxime, travel of the CN^- ions through the oxime to the silver anode, reaction rate at the anode, or the reaction rate at the cathode. The results of experiments performed here have indicated that increasing the amount of the agent absorbed by the oxime does not reduce the response time. Furthermore, the other factors listed above should not account for the long response times, 30 seconds to maximum, that have been observed. The rate of diffusion of the CN^- ion through the oxime layer has not been determined, but this could be an important factor.

An experiment will be conducted to explore the effect of changing the thickness of the oxime layer. A special cell will be constructed so that the oxime layer can be made as thin as possible. The same cell will be tested with a thicker layer of oxime and the cell response time will be measured. This model cell may also be used to study drift of the cell output. The specific application of the cell to the instrument system will be delayed until the response time is improved.

The first breadboard flash camera will consist of a flash illuminator and a standard vidicon television camera. The image intensifier tube will be tried later. Three television cameras have been evaluated in our laboratory, and we have purchased a Motorola, model S1120-A. The flash illuminator will be a triggered, air-gap source with quartz optics arranged to produce a thin sheet of light. The power supply and the trigger for the source are available at the Institute.

The depth of field of the objective lens was calculated for various focal numbers. This calculation showed that the depth of field was very shallow, about 0.2 mm; therefore, the thickness of the sheet of light will be very critical. When the camera is assembled we will determine the focal number that must be used to get enough light and this will determine the actual thickness of the sheet that we must use.

The experiments with the breadboard model camera are important because they will determine the smallest particle size that we can count, necessity of using the image intensifier, detailed requirements for the flash illuminator, feasibility of using a fluorescent additive, and range of concentration that can be measured. Some of the logic circuits for obtaining particle size information have been built, and they will be tested with the experimental camera.

A schematic diagram of the logic circuit being developed for sizing and counting particles is shown in the attached figure. The basic sizing principle is the counting of the number of scanning lines intercepted by a given particle. Tests were made to determine if there would be any advantage in measuring size by detecting the greatest pulse width associated with a given particle, and the conclusion is that there would be only a slight increase in size resolution, if any at all. The size resolution in either case is limited by the vidicon beam size. The line counting system was adopted because of its greater simplicity.

Referring to the schematic, two measuring channels are shown with connections to additional channels indicated. The number of channels required will depend on the concentrations encountered; the requirement is that the number of particles intercepted by any scan line cannot exceed the number of channels. For example with two channels, the third particle intercepted by a given line would not be counted.

The various circuit elements indicated in the schematic have been constructed and tested, and a breadboard of a complete channel is about half finished. The scaler and register are commercially available circuits, and a decision whether to purchase them or construct them will depend on the ease of adapting a commercially available circuit to our requirements. The decate counters to be used as final readout devices can be composed of about two decades per size range, and all channels will be fed to one set of counters.

The evaluation of the flash camera will be continued in March and April. The experiments with the electrochemical cell will be conducted by Don Brady, Research Chemist. Mr. Brady and Dr. Barrett were responsible for the original cell-development program and the alarm development. Robert Collins and Alvin Bird prepared this report.

Yours very truly,

Alvin N. Bird, Jr.

Alvin N. Bird, Jr.
Research Physicist
Instrument Development Section

Approved:

Sabert Oglesby, Jr.

Sabert Oglesby, Jr., Head
Engineering Division

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Contracting Officer, U.S. Army Chemical
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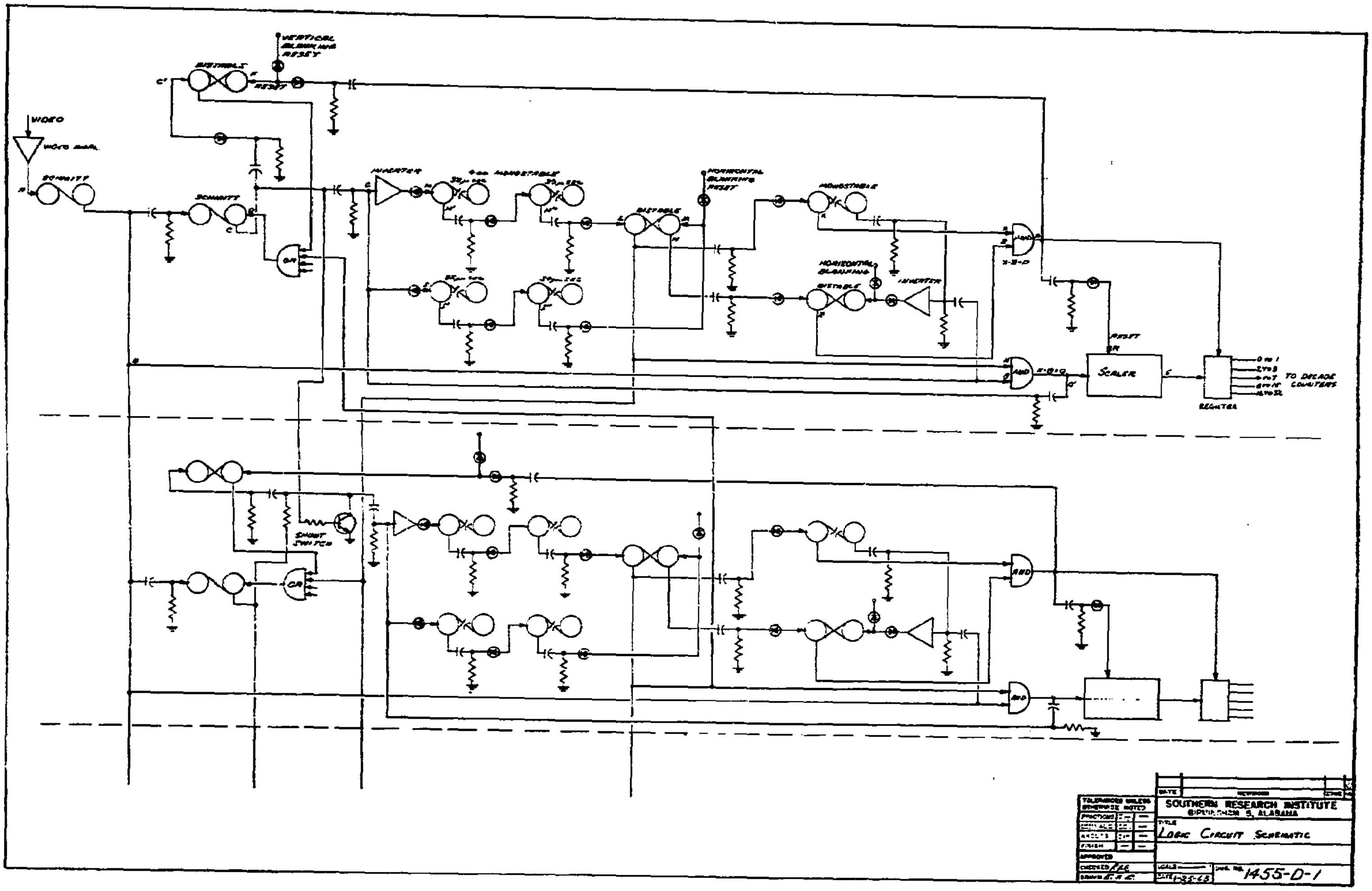
Attn: Mrs. Anne H. Schwartz (1 copy)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